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MECHANICAL SPREADERS FOR GRASSHOPPER BAIT

BY

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AND
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MECHANICAL SPREADERS FOR GRASSHOPPER BAIT

H. J. KEMP¹, S. H. VIGOR² AND K. M. KING³

This pamphlet has been prepared to give farmers information on the construction of satisfactory mechanical bait spreaders, built largely or entirely from parts of old machinery which may be readily available to them; and to show clearly the place of mechanical spreaders in relation to the whole program of grasshopper control.

When properly constructed and correctly used, the mechanical bait spreader affords marked advantages, not only for general poisoning over large acreages, but also where repeated baiting is necessary, such as on large, severely infested roadside egg-beds, the edges of crop being rapidly invaded, and trap-strips in summer-fallow. The need to cover large acreages of infestation arises particularly in connection with the "stubble" hopper, which lays its eggs throughout stubble fields and abandoned land. Widespread infestations may also occur in slough or pasture land. Wherever found, it is decidedly worth while to destroy such infestations by an immediate general treatment, thus preventing later migration to crop. Should a promising crop be generally invaded by either young or flying grasshoppers, it is both feasible and economical to save it by immediate poisoning of the entire field. With extensive migrations of winged hoppers, a second treatment is sometimes necessary.

In both types of situation the spreader makes it easy for the farmer to cover a large area during the short periods of the day when grasshoppers are very actively feeding. This ensures maximum kills and greater saving of crop. The spreader also saves in the time and labour required to protect large acreages, and permits thinner and more uniform application of bait.

To secure these advantages, however, care must be taken to:—

- (1) *Spread bait only when hoppers are actively feeding.*
- (2) *Run the spreader only where hoppers are present at the time in considerable numbers; for small areas spread the bait by hand.*
- (3) *Allow three to four days before rebaiting, so that the poison has time to take full effect. However, when new hatching or migration is rapidly occurring, treatment every second or third day may be necessary in limited areas.*
- (4) *Spread the bait very thinly.* For example, with a spreader covering a swath 20 feet wide, a bran sack of bait should treat a strip at least two to four miles long. In treating large acreages it is sometimes well to bait strips about a rod apart, in which case a bran sack of bait is sufficient for 10 to 20 acres. Besides saving bait, thin spreading is actually more effective, and avoids all possibility of danger to live stock.
- (5) *Use well-screened materials in poisoned bait, otherwise the opening in the bait-hopper of the spreader will clog.* Three-quarter-inch chicken netting has been found most suitable for screening the sawdust before mixing.

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NOT A "CURE-ALL"

In a really effective grasshopper control campaign the spreading of poison bait must be combined with careful planning of the whole farm program, and the best use of tillage operations, especially in the handling of land being summer-fallowed. In areas severely infested by the stubble hopper "stubbling in" of crop is likely to be unprofitable.

Hand spreading is still the principal means of scattering grasshopper bait, and is a very efficient method, especially where infestation is scattered. Hence no farmer need be discouraged, nor should he abandon his efforts merely because he does not have a mechanical bait spreader.

Whether spread by hand or machine, water bait is most effective only when scattered during the short period of the day when hoppers are actively feeding. The time varies from day to day, being determined by temperature and other weather conditions.

Detailed information on these essential points is available in publications which may be obtained free by writing to the provincial Department of Agriculture at Edmonton, Alta., Regina, Sask., or Winnipeg, Man.; or to the Dominion Entomological Laboratory at Lethbridge, Alta., Saskatoon, Sask., or Brandon, Man.

CONSTRUCTION OF THE SPREADER

A great number and variety of mechanical bait spreaders have been constructed and operated by farmers in the Great Plains area of the United States and Canada, because of the heavy infestations of stubble grasshoppers in recent years. Five general types of mechanical bait spreaders that can be recommended are described and illustrated below.

It is not expected that a spreader will be constructed exactly as described here as the different machines are to be made mainly with discarded or borrowed parts from other machines, and with tools usually found on the farm. The parts available may vary in shape, size and in other respects. Nevertheless, both principles and details here shown should be followed as closely as possible, and then the builder must devise ways and means to complete the machine.

A home-made bait spreader should be of simple design, cheap to construct, and preferably made in a single unit or assembly so as to be readily attached or detached from the wagon or truck. If the work can be done during the winter months, the time required may not be a serious consideration.

The essential features common to all five types are:—

- (a) A revolving spreader table of such type and elevation as to be capable of throwing the wet bait thinly and evenly over a wide swath.
- (b) A means of gearing the spreader table to the wheel of a wagon or car, in such a way as to revolve it at a suitable speed in relation to the speed of the vehicle.
- (c) A hopper for holding a suitable quantity of bait.
- (d) A feeding device that will ensure a uniform supply of bait to the spreading table.

TYPES OF FEEDS

HAND FEEDS

The feed can be operated either by hand or by an automatic device. With either type it is important that the bait be placed in such a position on the table that it will be spread in the desired direction, as when baiting road allowances, edges of fields or other places where it is necessary to throw the bait either to right or left. With a hand feed, the bait is applied with a small paddle or stick in very small quantities at close and regular intervals so that the bait will be scattered as uniformly as possible.

AUTOMATIC FEEDS

An automatic feed requires a hopper which will hold from two to three bushels of bait. The hopper should be movable or so constructed as to permit the bait to drop in any desired position on the table. It may be a barrel or drum set up on end or a cone or large funnel similar to that on a grain crusher. Since wet bait is heavy and is inclined to pack and not run freely through an opening, a baffle near the bottom of the hopper will keep considerable of the weight of the bait off the feed device at the bottom. The bait below the baffle is then in a loose condition and the feed device will usually work quite freely. The feed device can be a piece of flat iron bar about $1\frac{1}{2}$ by $\frac{1}{4}$ inch and fastened to the vertical drive shaft; or it may be a piece of $\frac{1}{2}$ -inch round iron attached to the drive shaft or connected with the centre of the spreading table, and bent at one end to project through a hole in the bottom of the hopper. Another satisfactory type of agitator consists of an eccentric fixed to a vertical drive shaft, giving a horizontal back-and-forth motion to an agitator feed bar in the bottom. The amount of bait delivered can be regulated by adjusting the size of the outlet in the bottom of the hopper. For most machines this opening may be $1\frac{1}{4}$ inch wide and 4 inches long. A slide is all that is required to vary the size of this opening.

THE SPREADER TABLE

Different kinds of fans or spreaders are used. Some farmers use automobile or tractor radiator fans, which may also have grooved pulleys attached. Others use the straw spreaders which are supplied with combine reaper harvesters, or disks from disk ploughs or one-way disks. Still others prefer to construct the spreader blades themselves. A smooth metal or wooden disk or table is fastened to the under side of the blades. The blades and table then form what is conveniently called a spreading table. The blades and table thus rotate together.

The width of spread of the bait is largely determined by the diameter, height above the ground, speed of rotation and tilt of the table. It is estimated that a spreader table 3 feet in diameter, geared to a 48-inch wagon wheel so that the spreader table turns about ten times for every time the wagon wheel turns once, will scatter bait over a strip about 16 to 20 feet wide, or six acres per hour when the wagon is travelling three miles per hour. If the same spreader wheel was geared to a truck wheel travelling 15 miles per hour, the bait can be made to spread over a strip 30 to 40 feet wide, or about 60 acres per hour.

Construction of the mechanical spreader should be such that bait leaving the spreader table does not hit braces or any part of the machine, as that would reduce the width of spread.

DRIVING GEAR

Drives for types that are mounted on wagons or trucks consist chiefly of a pulley or chain sprocket clamped to the wheel. Chain sprockets such as are used with header or binder bull wheels are satisfactory, if the hubs and a sufficient part of the spokes are removed to enable it to be clamped to a wagon wheel. An automobile tire rim makes an excellent drive pulley when clamped to a wheel, and if it is lagged with a piece of old rubber belting, it is quite satisfactory for driving a chain with a sprocket on the bait spreader drive shaft. An old iron tire from a discarded drill or wagon wheel can be reduced to about 36 inches in diameter to serve as a pulley when clamped to a wagon wheel. These drive sprockets or improvised pulleys usually give best results when clamped on the inside of wagon wheels. Automobile brake drums or ordinary

pulleys about 12 inches to 16 inches in diameter can be used with truck wheels and fastened on the outside of the wheel. A tightener pulley with spring tension to keep the chain or drive belt taut is essential. This tightener pulley can serve as a clutch to start or stop the bait spreader.

The drive for the types which are constructed from the wheels and rear axle assembly of discarded automobiles is already provided for. When the propeller shaft is placed in a vertical position it supplies an excellent drive shaft for the spreader table.

Because of the difference in gear ratio in different automobiles, it is sometimes necessary to use additional gears or other means to increase the speed of the spreader table and thus throw the bait the desired distance. This applies especially when the auto trailer type is drawn by horses and also when the required spread of bait cannot be obtained unless the machine is hauled faster than the rate of about 15 miles per hour, which is the maximum suitable for travel on baiting areas.

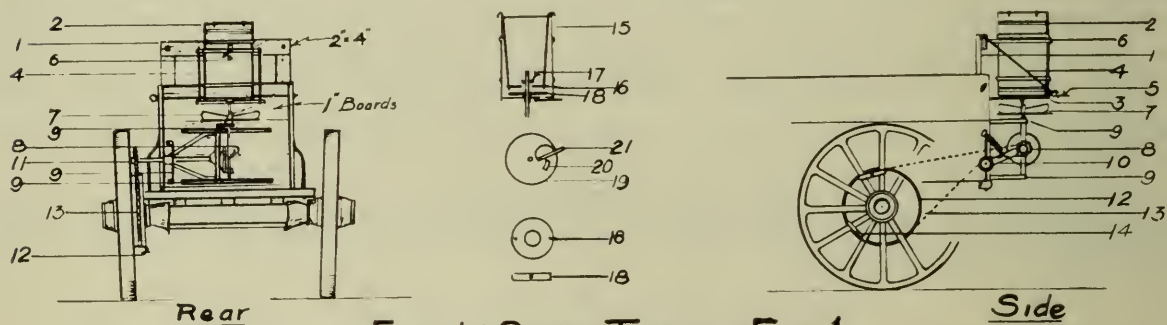
FIVE TYPES OF SPREADERS

The following five types are described:—

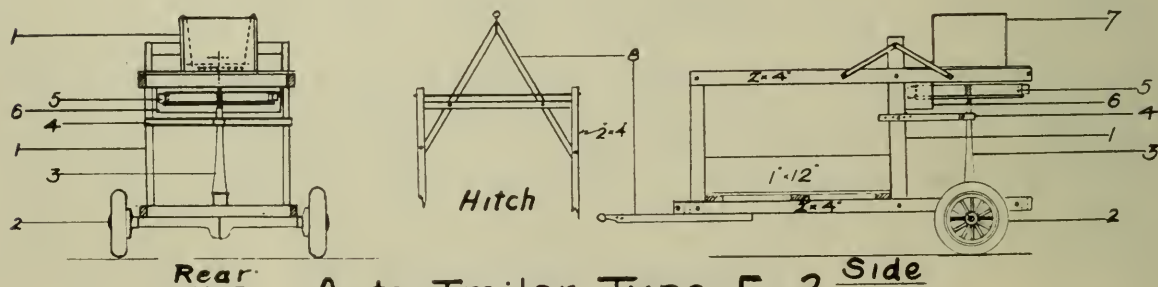
- (a) End gate type.
- (b) Auto trailer type.
- (c) Combine straw spreader type.
- (d) Cone-hopper wagon or truck type.
- (e) Truck trailer type.

END GATE TYPE

Essential parts consist of: A specially constructed end gate on which is mounted a 14- by 22-inch oil drum, or any 25-gallon drum; a binder reel gear assembly with an automobile radiator fan for spreading the bait. The machine



End-Gate Type. Fig. 1



Auto-Trailer Type. Fig. 2



FIG. 3.—Endgate bait spreader.



FIG. 4.—Endgate bait spreader.

obtains its power through a sprocket chain from an automobile tire rim which is clamped to the spokes of the wagon wheel. A piece of rubber belting wrapped around the tire rim serves as lagging and prevents the chain from slipping. A chain tightener kept taut by a spring also serves as a clutch by simply slackening or tightening the chain as required. A removable baffle two inches smaller in diameter is supported by one-quarter-inch round iron rods about two inches above the agitator bar. A $1\frac{1}{2}$ - by 4-inch hole is made in the bottom of the barrel about two inches from the edge. The amount of bait delivered is controlled by a pivoted slide. The barrel may be rotated right or left and fastened in position by a lock screw so that the bait will fall on the right or left side of the fan blades, depending on the desired direction of spread.

Parts as numbered in figure 1 are as follows:—

1. Special removable end gate.
2. Oil barrel about 14 by 22 inches.
3. Barrel support bracket, $2\frac{1}{2}$ - by $\frac{3}{8}$ -inch iron.
4. Iron pipe, 1 inch diameter by 18 inches long.
5. Brace rod, $\frac{5}{16}$ -inch round iron.
6. A loose-fitting hoop of 1- by $\frac{1}{4}$ -inch flat iron to support barrel and permit barrel to be moved around to direct bait. Lock screw holds barrel at desired setting.
7. Auto radiator fan from 16 to 18 inches in diameter with disk of sheet metal attached to lower side of blades and a bushing with a square hole to fit the square propeller shaft of the binder reel assembly. This bushing is brazed in position.
8. Massey-Harris binder reel gear assembly, or any other bevel gear assembly providing a four or five to one ratio.
9. Three brackets of $1\frac{1}{2}$ - by $\frac{1}{4}$ -inch flat iron to attach reel gear assembly to end gate.
10. Chain-tightener wheel with spring tension. When in slack position wagon can be moved without turning the spreader.
11. Sprocket with eleven to thirteen teeth to fit No. 52 chain.
12. Automobile tire rim lagged with rubber belting.
13. Chain; link size No. 52.
14. Four clamps to hold tire rim to wheel.
15. Four $\frac{1}{4}$ -inch round rods to support baffle.
16. Sheet metal baffle 1 inch smaller in diameter than barrel and with 3-inch hole in the centre.
17. Three split pins to prevent bait bridging above 3-inch hole in the baffle.
18. Wiper or rotating feed bar made from 2- by $\frac{1}{4}$ -inch flat iron. Square hole in the centre to fit square shaft from reel assembly. Washers should be placed under this bar to prevent it from scraping the bottom of the hopper.
19. Bottom of the hopper.
20. Hole $1\frac{1}{2}$ by 4 inches through which bait falls.
21. Slide or gate pivoted to bottom of hopper and handle and supported to keep it from bending downward.

An end gate type of bait spreader, constructed according to the above specifications, is shown in figure 4 on page 9. Another similar bait spreader, using a bevel-gear drive, is illustrated in figure 3 on page 9.



FIG. 5.—Autotrailer bait spreader.

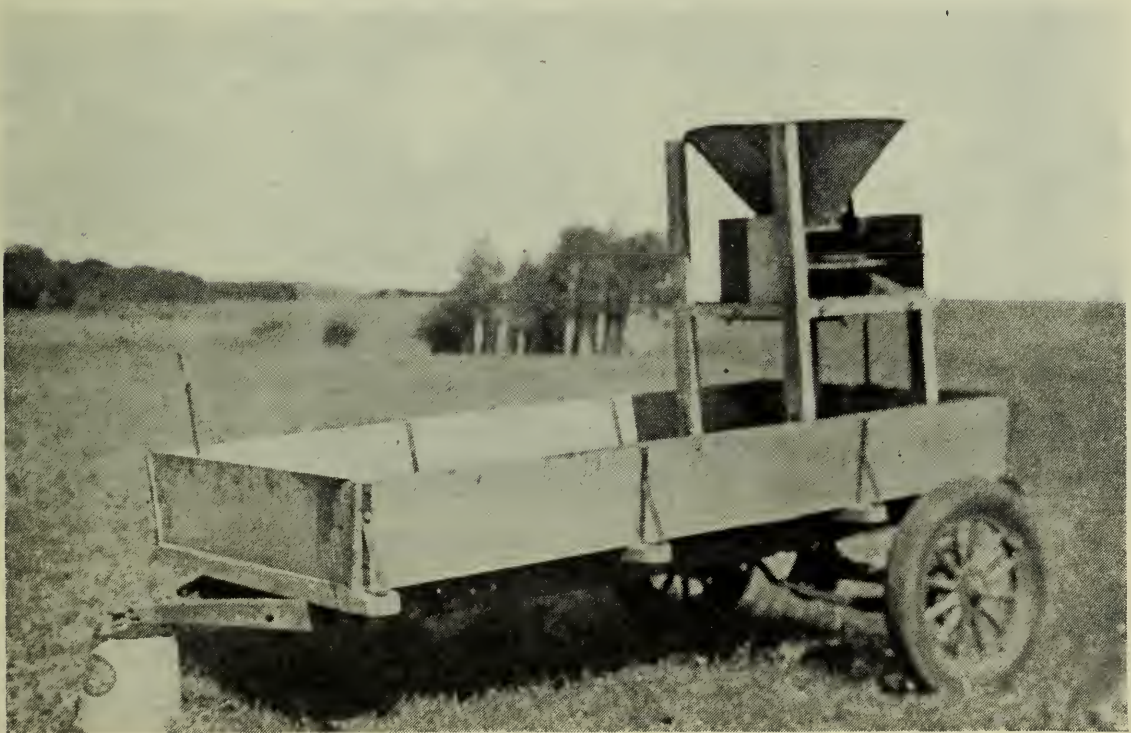


FIG. 7.—Autotrailer bait spreader.

AUTO TRAILER TYPE

The principal parts for this spreader are: A rear axle and gear assembly including the propeller shaft and housing and the wheels; the lower half of an oil barrel; a rotating fan or distributor; a wood or angle iron frame to form a trailer to carry bait; a place where the operator may stand, and a few minor parts.

Parts as numbered in figure 2 are as follows:—

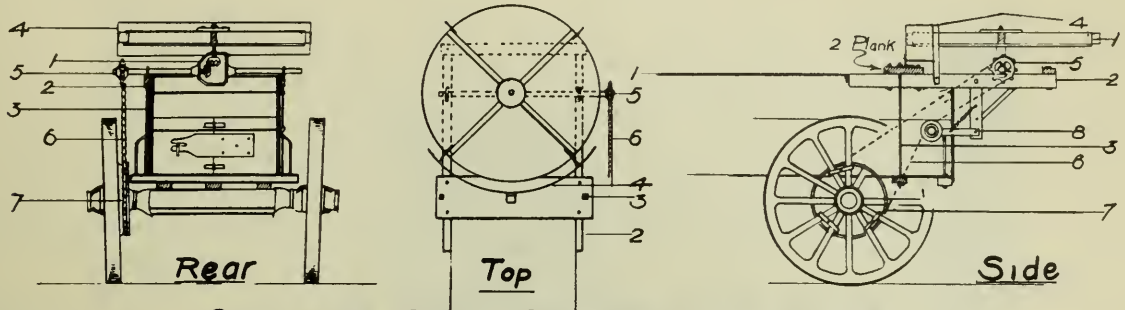
1. A frame constructed with 2- by 4-inch and 1- by 10-inch lumber or with angle iron 2 by 2 by $\frac{3}{16}$ inches.
2. Rear axle and wheels. The frame is bolted directly on to the axle housing.



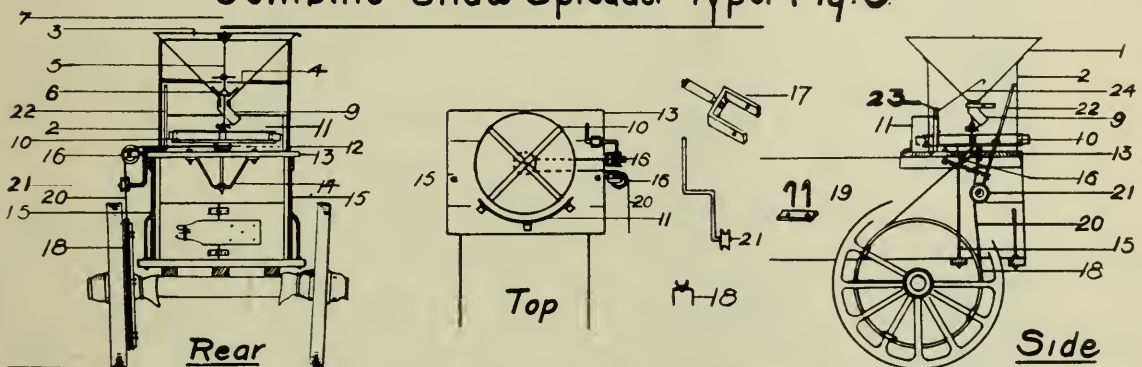
FIG. 6.—Autotrailer bait spreader.

3. The propeller shaft is almost vertical. The propeller shaft housing is cut down to about 36 inches in length. Babbitt or hardwood may serve as a bushing or bearing at the cut end of the propeller shaft housing. Where the propeller shaft is not round or smooth, it may be advisable to omit this bushing. The remaining, protruding portion of the propeller shaft is used for attaching the fan or distributor and rotating the agitator or feeder bar inside the hopper.

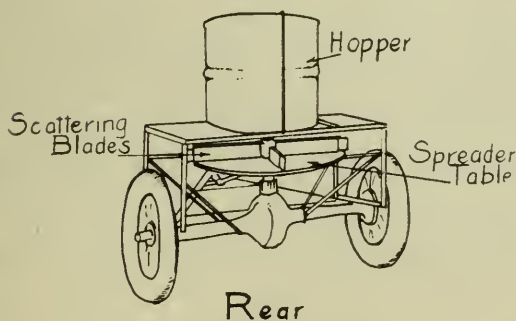
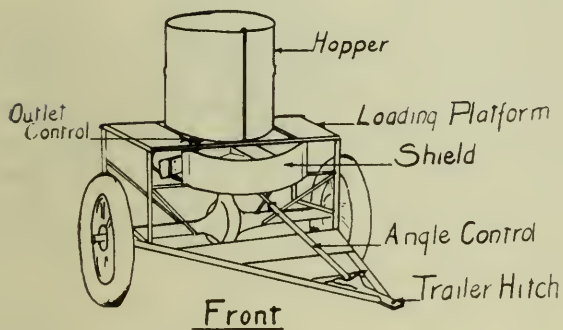
Various Grasshopper Bait Spreaders



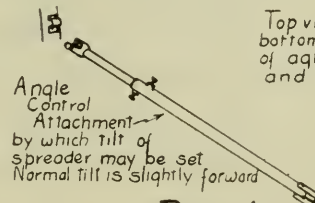
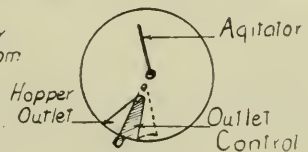
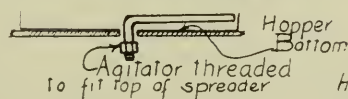
Combine Straw-Spreader Type. Fig. 8.



Wagon or Truck Cone-Hopper Type. Fig. 9.



Spreader Table
diameter 3 feet
Supported by frame
and fits around drive
shaft. Blades fastened
to table. Blade head
screwed to drive shaft.
Drive shaft shortened to
place spreader table
16 inches above axis.



Detail

Grasshopper Bait Spreader - Fig 10.

4. Adjustable braces of 2- by $\frac{1}{4}$ -inch flat iron with five or six $\frac{1}{2}$ -inch holes $1\frac{1}{2}$ inches apart drilled at the frame end. These adjustable braces allow the revolving spreader to be inclined a little forward so that the bait will be thrown slightly upward and to a greater distance as may be required.
5. A revolving spreader 3 feet in diameter. The blades may be constructed of 1- by 3-inch lumber. These are fastened to disk or table below. The table may be constructed with $\frac{3}{4}$ -inch lumber or $\frac{3}{8}$ -inch veneer and covered with sheet metal to give a smooth surface. A hub for the spreader table may be made from a hub, bushing or similar machine part. This hub should be secured to the propeller shaft by two set screws at right angles to each other or with a taper pin through the hub and shaft. Pieces of rubber belting are attached to the tips of the blades which contact the shield when rotating.
6. A shield of curved sheet metal is located at the back of the fan to prevent the bait being thrown forward against the driver or operator.
7. A hopper made from an oil drum. The construction of the hopper, the baffles, agitator or feed bar, feed opening and control, are similar to that used for the end gate type previously described.
8. Auto trailer hitch of 2- by 2- by $\frac{1}{4}$ -inch angle iron.

An auto trailer type of bait spreader, constructed mainly according to specifications suggested above, is shown in figure 6, on page 12. The main difference is in the construction of the trailer box and the iron bracing. This variation may serve to illustrate how any suggestions, by way of sketches or photographs appearing in this publication, may be changed to suit the parts or materials on hand.

Two other excellent auto trailer types of bait spreaders, made by farmers, are shown in figure 5 and figure 7.

COMBINE STRAW SPREADER TYPE

This equipment may be adapted for use with either a wagon or a truck. The straw spreader assembly from a combine harvester-thresher together with a wood or metal frame and an automobile tire rim or a pulley are the principal parts required. The spreader is mounted on a frame on top of the wagon or truck. It is quickly attached or detached by means of a half-inch round iron tie rod on each side of the box connected to a 2-by-4 cleat below the box. This arrangement also permits the chain or belt to be sufficiently tightened by sliding the spreader back before it is clamped into operating position.

No automatic feed hopper is provided, although one similar to others described for other types of spreaders may be added if required. When no feed hopper is used, the bait is thrown on to the revolving table by hand in small amounts at regular intervals. To scatter the bait in the desired direction the operator applies the bait to the right, rear or left of the revolving table as is determined by trial. Parts as numbered in figure 8 are as follows:—

1. Straw spreader from combine harvester-thresher, including fan blades and mitre gears. Rubber belting attached to tip of the blades.
2. Wood frame constructed of 2- by 4-inch lumber and a piece of 2-inch plank.
3. Tie rods, $\frac{1}{2}$ -inch round iron.
4. Sheet metal shield attached to wood frame with 2- by $\frac{1}{4}$ -inch iron strap.
5. Sprocket gear, about nine to eleven teeth for size 52 chain or similar.
6. Sprocket chain, link size about 52.

7. Automobile tire rim fastened to wagon wheel with four clamps. The tire rim is lagged with a piece of rubber belting to prevent the chain slipping.
8. Chain tightener attached to 2- by $\frac{1}{4}$ -inch flat iron arm pivoted to the wood frame. A spring supplies the necessary tension. When this chain tightener is slack, wagon can be moved without operating the spreader.

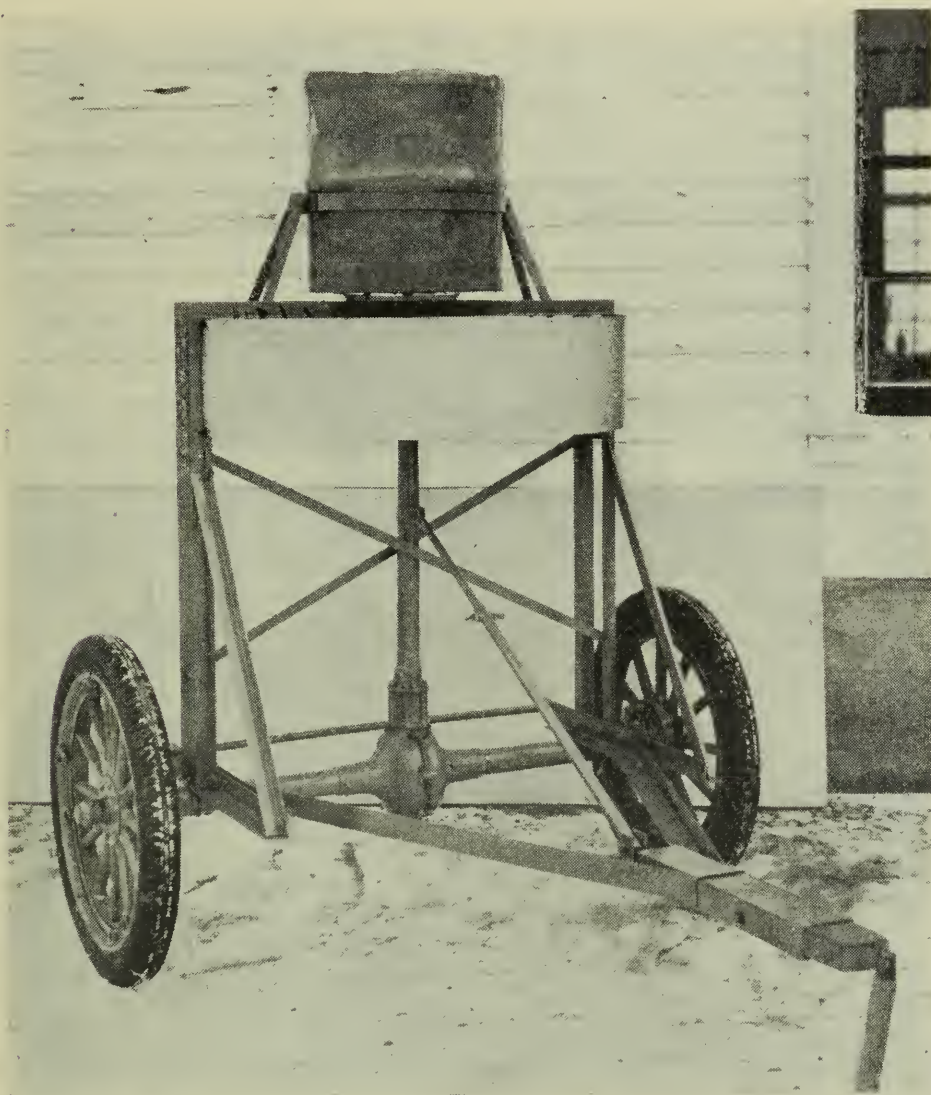


FIG. 11.—Truck-trailer bait spreader (front).

WAGON OR TRUCK CONE-HOPPER TYPE

The cone-hopper wagon or truck type has been especially designed at the experimental station, Swift Current, to make possible the construction of a simple bait spreader from stock materials when suitable discarded parts are not available. Tradesmen may also find this type suitable for local manufacture.

The cone-hopper spreader may be constructed to fit on a wagon or truck box. The machine obtains its power from one of the rear wheels through a belt, preferably round or V-shaped, or a piece of sash cord to serve as a belt. This is connected directly with the spreader shaft by grooved pulleys, thus avoiding gears. A convenient belt tightener also serves as a clutch. The cone-shaped hopper feeds bait automatically to the rotating spreader table below. The amount of bait delivered is regulated by means of a wing nut on the top

of a vertical shaft in the centre of the hopper. Turning this wing nut right or left will raise or lower the small cone attached to the lower end of the vertical shaft situated just above the outlet at the bottom of the hopper. Raising or lowering this small cone increases or decreases the size of the outlet. Two short agitator arms are also attached to this cone. The vertical shaft is connected to the spreader table shaft below from which it obtains its rotary motion. A movable spout may be rotated horizontally by hand and set in any position to cause the bait to be spread in a desired direction.



FIG. 12.—Truck-trailer bait spreader (rear).

Parts numbered in the figure 9 are as follows:—

1. Sheet metal cone-shaped hopper, about 36 inches in diameter across the top.
2. Supports for hopper, flat iron, $1\frac{1}{2}$ by $\frac{1}{4}$ inch.
3. Support for feed control rod, $1\frac{1}{2}$ - by $\frac{1}{4}$ -inch flat iron.
4. Lower support for feed control rod, $1\frac{1}{2}$ - by $\frac{1}{4}$ -inch flat iron.
5. Feed control rod, $\frac{1}{2}$ -inch round iron, threaded at top end, fork-shaped at lower end to connect to spreader table shaft below, and secured by a loose-fitting split pin or bolt.
6. Metal cone and two $\frac{1}{4}$ -inch round iron agitator arms attached to the feed control rod 5.

7. Wing nut at top end of feed control rod to regulate the size of feed opening between the metal cone 6 and the sides of the hopper.
8. Agitator made of two $\frac{1}{4}$ -inch round iron arms attached to opposite sides of a collar. Collar fitted with set screw to enable agitator to be set in proper position on the feed control rod 5.
9. Sheet metal spout (4-inch rain water 45-degree elbow) may be turned by means of a handle and clamped in any position so that the bait may be dropped on any part of the table.
10. Spreader table, 30 inches in diameter, consisting of four blades made from 4- by $1\frac{1}{4}$ -inch lumber fastened to a wood disk, the top of which is covered with sheet metal. A hub with a bore equal to the size of the propeller shaft is required. The hub may be secured to the shaft by two set screws at right angles to each other or, better still, it may be keyed and set screwed. Rubber belting is fastened to the tips of the blades. The pieces of belting should be of sufficient length to just contact the shield No. 11.
11. Shield of sheet metal at back of the fan blades, about 10 inches high and fastened to wood platform No. 13 by pieces of 2- by $\frac{3}{16}$ -inch strap iron bent to suit.
12. Grooved pulley about 4 to 6 inches in diameter fastened to spreader table propeller shaft.
13. Wood platform constructed of 2-inch lumber. Hopper and spreader table are mounted on this platform. Platform may be moved back or forward to secure the right tension of the belt. It is secured in position by tightening the tie rods.
14. Brackets to support the spreader table propeller shaft. Made from 2- by $\frac{1}{4}$ -inch flat iron. Also holds a bushing or bearing for the lower end of the propeller shaft.
15. Tie rod of $\frac{1}{2}$ -inch round iron connected to wood platform on top of the box and a 2-by-4 cleat below the bottom of the box to hold platform in position.
16. Grooved guide pulleys about 4 inches in diameter.
17. Swivel bracket for grooved pulley No. 16. Brackets made from $1\frac{1}{2}$ - by $\frac{3}{16}$ -inch flat iron. Swivel formed with piece of $\frac{1}{2}$ -inch pipe over a round iron stem.
18. Pulley or circular band iron drive wheel clamped to wagon wheel. May be constructed from discarded wagon or drill wheel tire and reduced to 36 inches in diameter. A groove for the drive rope or belt is provided by splitting a piece of $\frac{3}{4}$ -inch rubber hose riveted around the outside of the drive wheel. (See small sketch No. 18.) A 14- to 16-inch pulley may be used on truck wheels.
19. Hooks of $\frac{1}{2}$ -inch round iron and a plate made from $1\frac{1}{2}$ - by $\frac{5}{16}$ -inch flat iron will serve to clamp circular iron band drive to wagon wheel.
20. Rubber "V" belting or $\frac{1}{2}$ -inch window sash cord.
21. Grooved tightener pulley 4 inches in diameter.
22. Crank arm for tightener pulley made from $\frac{5}{8}$ -inch or $\frac{3}{4}$ -inch round iron. Crank arm is pivoted on the wood platform with a plain strap iron bearing or keeper. A coil spring fastened between the platform and crank arm provides tension for the belt.
23. Support for $\frac{3}{8}$ -inch round iron hook.
24. Hook of $\frac{3}{8}$ -inch round iron holds tightener pulley in slack position in order to move wagon or truck without operating the bait spreader.

TRUCK TRAILER TYPE

The device as described in figure 10 on page 13 is made from the rear axle and wheel assembly of a model "T" Ford car. Details are supplied by Mr. S. McCampbell, Extension Entomologist, Colorado Agricultural College, who states the following in a recent circular:—

"The drive shaft tipped upward to a nearly vertical position is used to rotate the spreader table upon which the bait is dropped. Blades fastened to the spreader table scatter the bait as the table rotates. By fastening the mechanical spreader behind a pick-up car or light truck, the scattering is done automatically, and all that is necessary is to keep bait in the hopper. By changing the speed of the truck or controlling the opening at the bottom of the hopper, the amount of bait that will be applied can be varied.



FIG. 13.—Truck-trailer bait spreader with wood frame.

"The hopper is made from half of a steel oil drum and is fastened rigidly to the frame. For convenience in filling the hopper, the drive shaft has been shortened and the device coupled closely to the truck.

"On rough ground the spreader may be pulled by horses. If the rate of travel is extremely slow it may be necessary to increase the gear ratio of the differential."

The truck trailer type of bait spreader shown in figure 11 and figure 12 on pages 15 and 16 was constructed by the Dominion Experimental Station, Swift Current, Saskatchewan, essentially along the lines suggested in figure 10. The main difference is in the frame construction and the height of the spreader

table. The hopper is made to fit loosely in its supports so that it can be moved readily and set in any position so as to scatter the bait in the desired direction.

Figure 13 shows a very simple device which is similar, in many respects, to figure 10. The simple wood frame commends itself to the builder with limited tools and materials.

Another type of spreader is shown below in figure 14, which uses a rotating disk from a disk plough or one-way disk. Five blades, about three-quarters of an inch high by one-quarter of an inch and slightly curved, are welded to the concave or hollow side of the disk. The bait falling on the concave surface is thrown high and distributed widely.

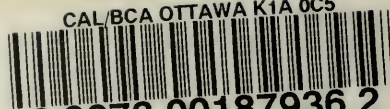


FIG. 14.—Bait spreader using discarded disk from one-way disk for spreader table.

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